United States Patent

[11] 3,589,527

[72] Inventors Orum E. Seay
Duncan, Okla.;
Jack G. Stephenson, Duncan, Okla.; Robert E. Abbott, Forth Worth, Tex.

[21] Appl. No. 744,947
[22] Filed July 15, 1968
[45] Patented June 29, 1971
[73] Assignee Halliburton Company
Duncan, Okla.

[54] **METHOD AND APPARATUS FOR CONTROLLING TRAIN ACTION EVENTS**
12 Claims, 17 Drawing Figs.

[52] U.S. Cl. 213/8, 213/43
[51] Int. Cl. B61g 9/16
[50] Field of Search 213/8, 43, 223; 267/64, 65; 188/88, 510, 96, 279, 284

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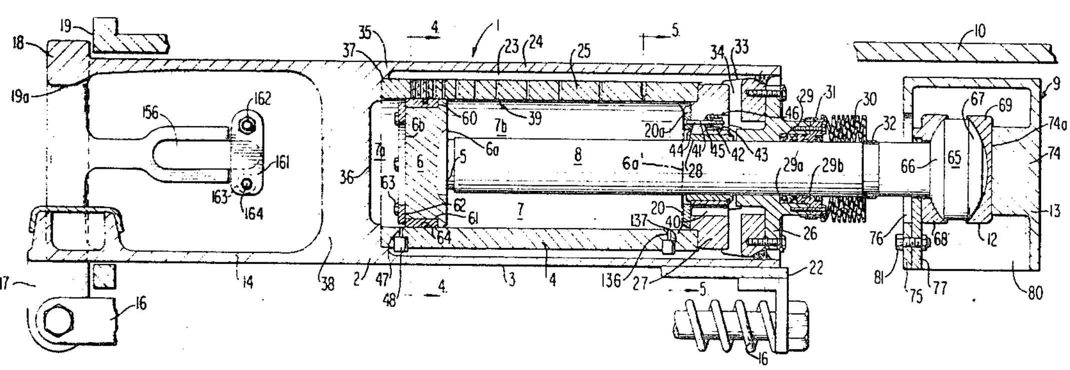
Primary Examiner—Drayton E. Hoffman
Attorney—Burns, Doane, Swecker and Mathis

ABSTRACT: Method and apparatus for controlling "run-in" train action and car coupling phenomena.

A normally open valve means continuously maintains a relatively low level of impedance operable to resist movement of draft gear except when a "run-in" phenomena is encountered. When a "run-in" phenomena is encountered, the valve means operates to increase an hydraulic impedance level acting on the draft gear so as to regulate draft gear movement during a "run-in" event.

A disabling mechanism operates to maintain the valve means in a relatively open condition when high level buff coupling forces are imposed on the draft gear so as to provide a generally low level of impedance resisting draft gear movement during the application of high energy impact shocks to the draft gear.



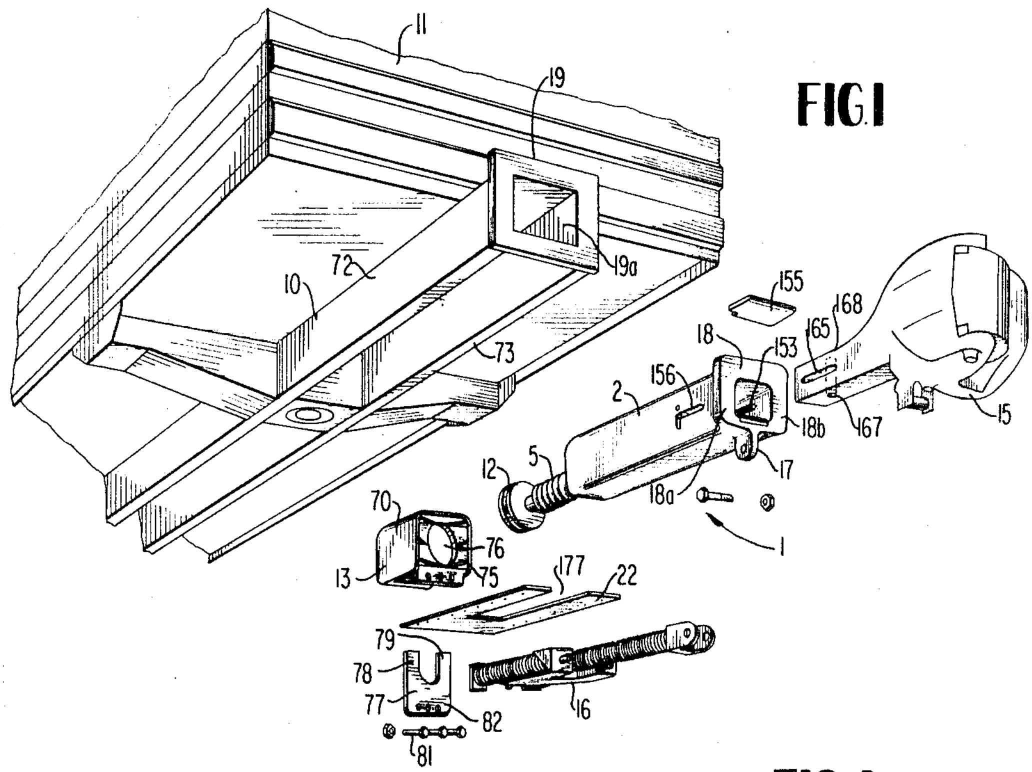


FIG. 1

FIG. 4

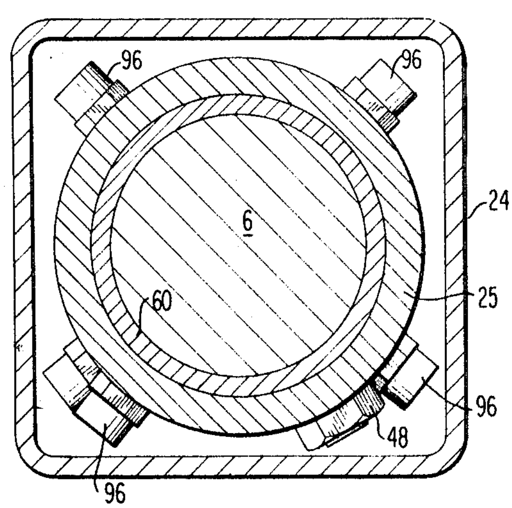
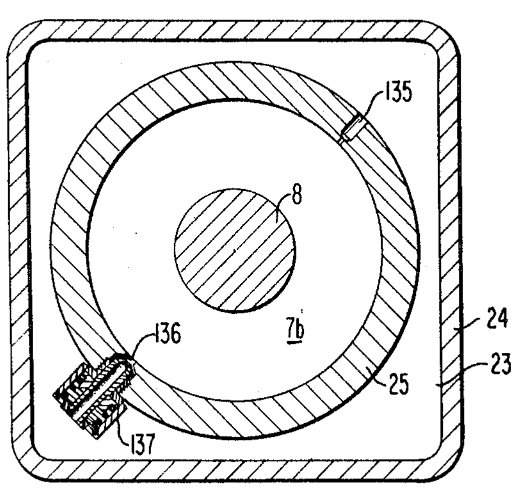


FIG. 5



INVENTORS
ORUM E. SEAY
JACK G. STEPHENSON
ROBERT E. ABBOTT

BY Burns, Doane, Benedict, Swecker & Mathis

ATTORNEYS

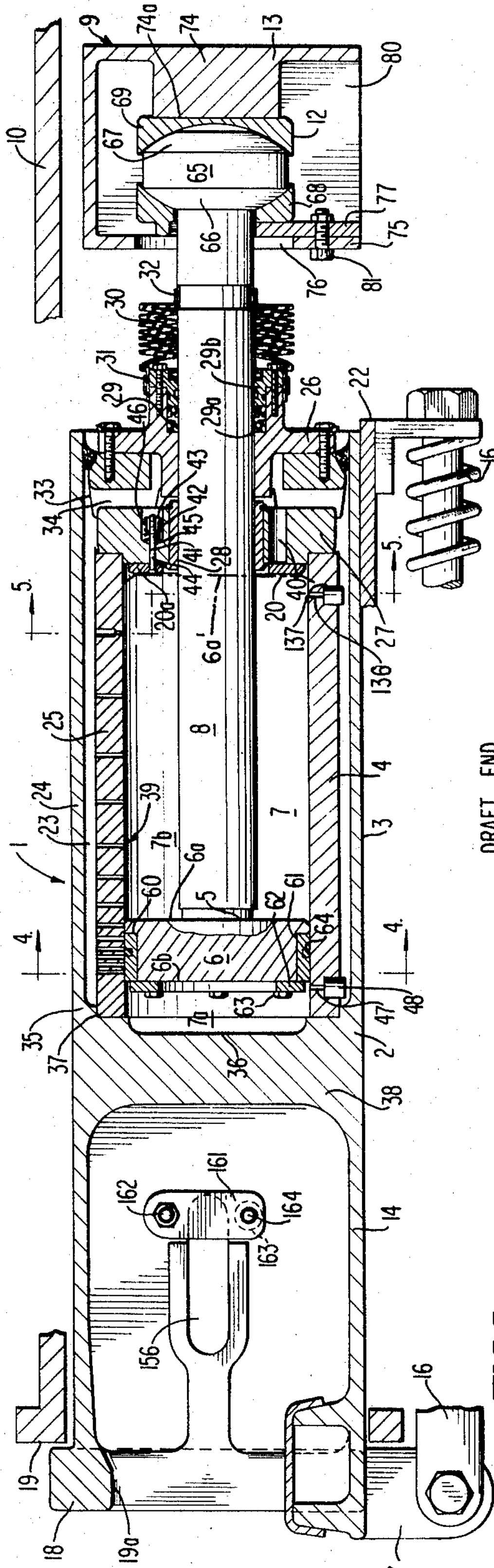


FIG 2

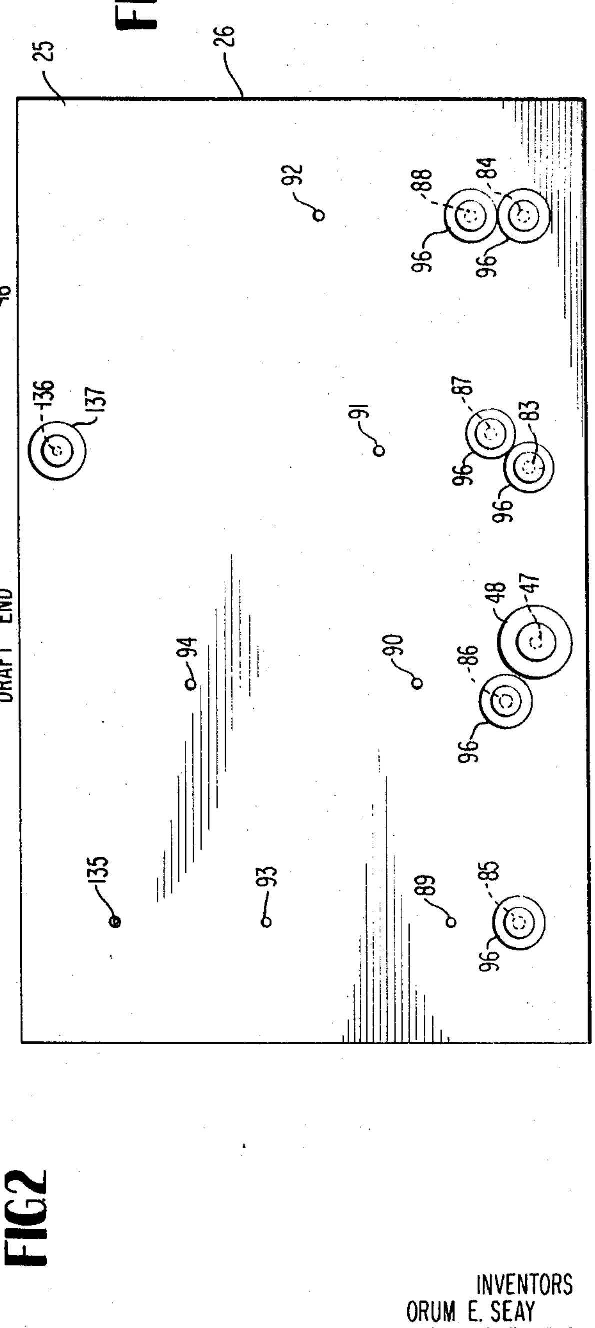


FIG 3

INVENTORS
ORUM E. SEAY
JACK G. STEPHENSON
ROBERT E. ABBOTT

BY Burns, Doane, Benedict, Swecker & Mathis

ATTORNEYS

FIG. 6

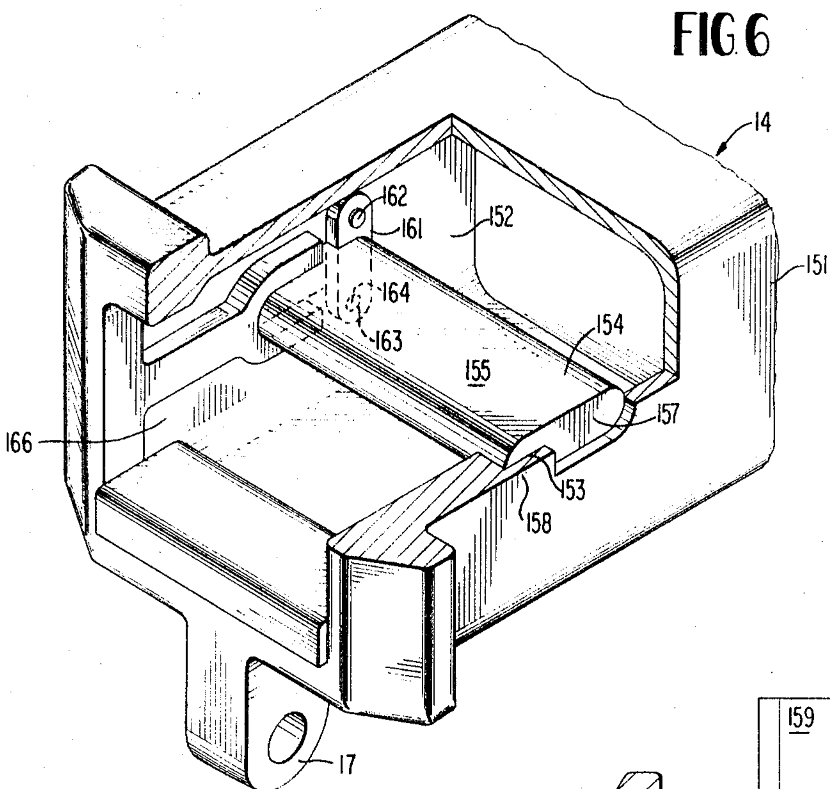


FIG. 7

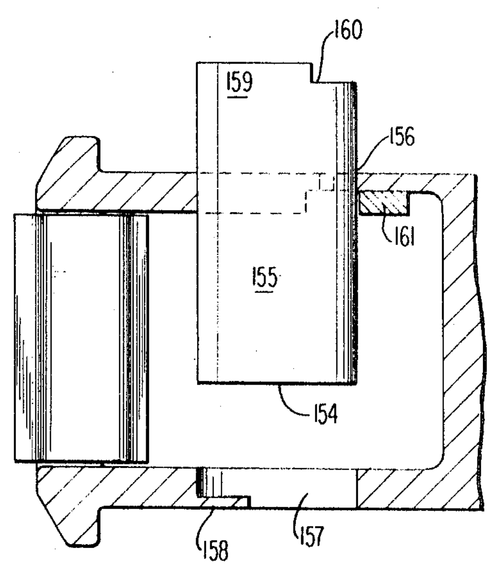
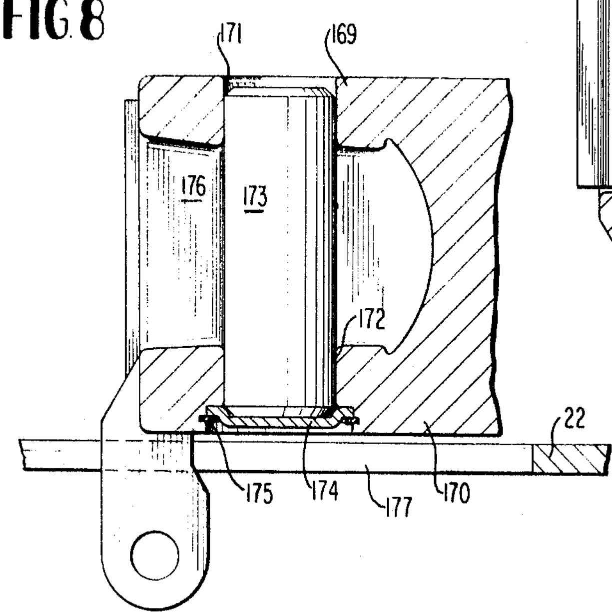


FIG. 8



INVENTORS
ORUM E. SEAY
JACK G. STEVENSON
ROBERT E. ABBOTT

BY Burns, Doane, Benedict, Swecker & Mathis

ATTORNEYS

FIG. 9

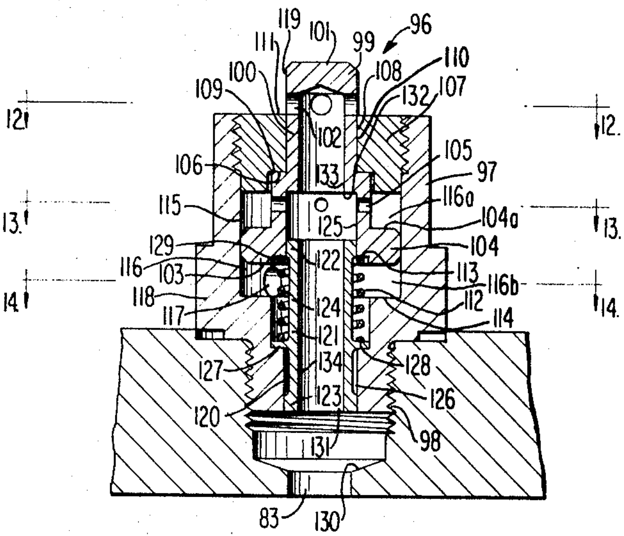


FIG. 12

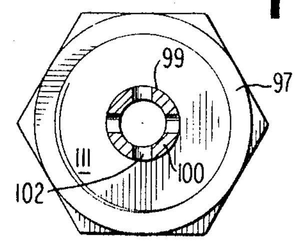


FIG. 13

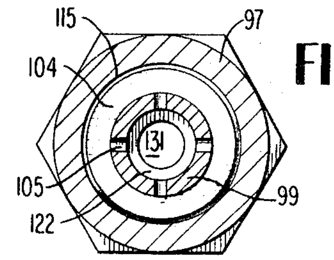
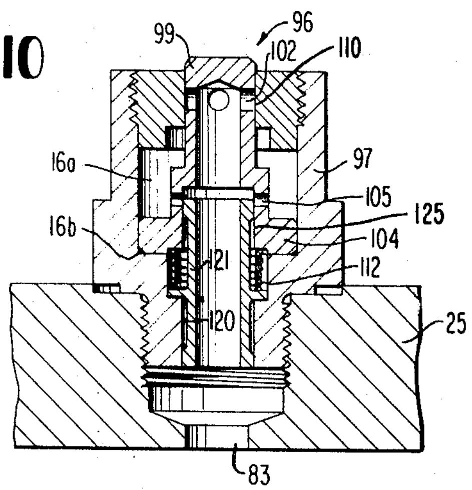


FIG. 10



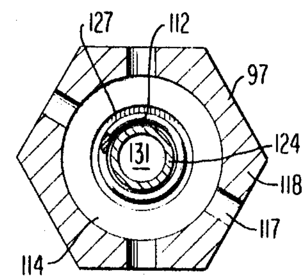
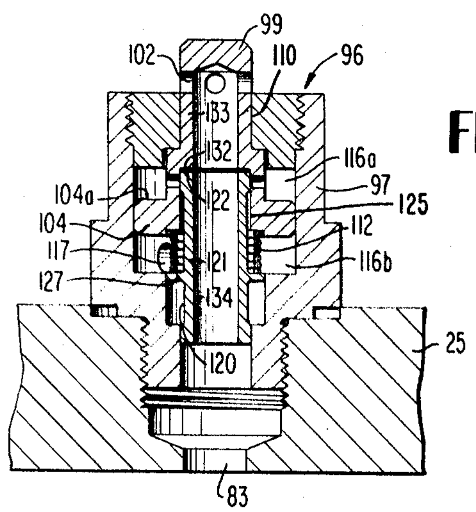


FIG. 14

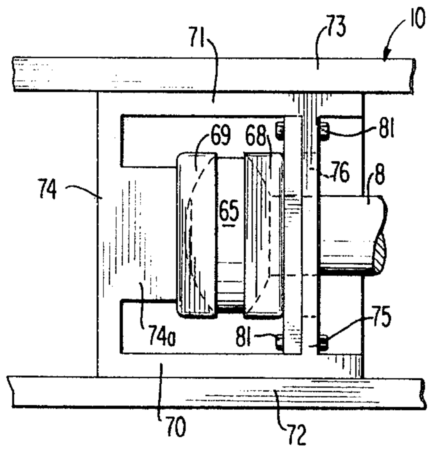
FIG. 11



INVENTORS
ORUM E. SEAY
JACK G. STEPHENSON
ROBERT E. ABBOTT

BY Burns, Doane, Benedict, Swecker & Mathis
ATTORNEYS

FIG. 15



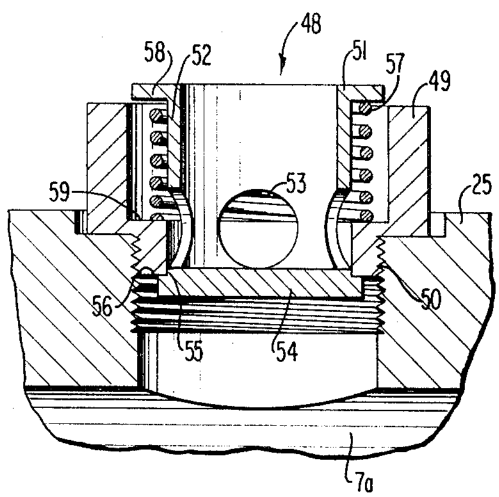


FIG. 16

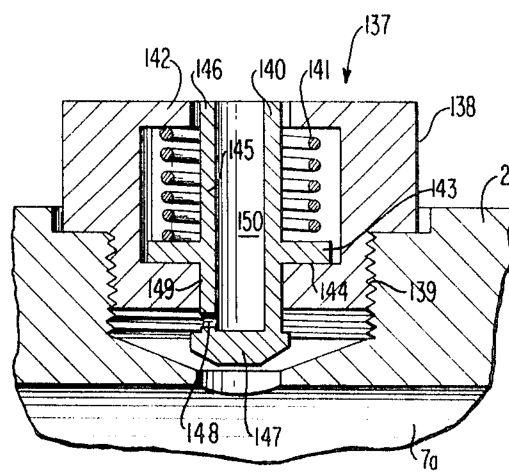


FIG. 17

INVENTORS
ORUM E. SEAY
JACK G. STEPHENSON
ROBERT E. ABBOTT

BY Burns, Doane, Benedict, Swecker & Mathis
ATTORNEYS

METHOD AND APPARATUS FOR CONTROLLING TRAIN ACTION EVENTS

RELATED APPLICATION

This application pertains to a railway cushioning device, and its mode of operation, and involves the utilization of a control valve mechanism described and claimed in U.S. Pat. application Ser. No. 752,649 to Stephenson et al. filed Aug. 14, 1968, and assigned to the assignee of the present application.

GENERAL BACKGROUND, OBJECTS AND SUMMARY OF INVENTION

Railway cars often carry goods and commodities which must be protected from shock. Thus, there has been a longstanding practice in the railway art to provide cushioning mechanisms in association with car coupling devices. Such mechanisms enable shock forces, generated during car coupling operations, to be absorbed without transmitting excessive shock to goods contained within the railway cars being coupled.

While cushioning devices provide a mechanism for absorbing coupling shocks, there still remains the problem of coping with "train action" events.

Train action events may be defined as a phenomena which occurs as a consequence of the existence of slack in the couplings between moving railway cars or train vehicles. Such slack enables the cars, in motion on a railbed, to undergo relative movement. Thus, "train action" denotes the equalizing of speed of adjacent cars which have undergone relative movement. A train action event is termed a "run-out" where adjacent cars are moving apart. Where moving cars are converging, the train action event is termed a "run-in."

There are several undesirable aspects associated with train action phenomena. While train action is occurring, crewmen experience an undesirable "floating" sensation. At the termination of train action events, shock forces are transmitted to coupling units and railway cars and often transmitted in a more or less "wave" form throughout a train. Such train action induced shocks are often severe enough to both damage goods carried by a train and cause injury to train crewmen. Indeed, the train action induced shock forces may be so severe as to induce derailment.

A major contribution to the railway cushioning art which provides a system for effectively coping with "run-out" train action events is featured in U.S. Pat. No. 3,451,561 to Stephenson et al.

While the Stephenson et al. concept provided a concept for effectively handling a "run-out" event, there remained a need, going beyond the teaching of this concept, for a method and apparatus which would effectively minimize or control "run-in" events.

The problems involved in coping with "run-in" events are particularly aggravating and seemingly mutually inconsistent from the standpoint of solutions.

The greatest forces ordinarily imposed upon a coupling are those encountered in a railway yard where a train is moving at relatively low speed and abruptly engages a car for coupling purposes. In order to absorb the high level shock generated during such coupling operations, it is necessary that a cushioning device have a capacity to move relatively rapidly and dissipate large amounts of energy on a fairly uniform basis.

However, when a train is in motion and lower level forces are acting on the coupling units so as to tend to induce a "run-in" phenomena, i.e., induce convergence of coupling units, the requisites of the cushioning device necessary to absorb high level coupling shocks are self-defeating. With the coupling unit being able to move rapidly so as to absorb coupling shock, its capacity to cause slow coupling movement so as to control "run-in" events is severely restricted.

Conversely, if the cushioning mechanism is designed to impede coupler movement to an extent sufficient to control

"run-in" events, the cushioning device will be unable to effectively absorb the high energy coupling shocks.

Many cushioning devices in present use are hydraulic in nature. The hydraulic nature of these devices engenders certain operational problems. Means must be provided for accommodating expansion of hydraulic fluid caused by heat generated during shocks absorption. Additionally, where the volume of a cushioning cylinder is altered by piston rod movements, it has heretofore often been considered necessary to provide accumulator units within the system for accommodating such volume changes. Such accumulator units introduced substantial structural complexity and also generally increased the size of the cushioning devices.

Other problems associated with cushioning mechanism have involved structural complexity in relation to how the mechanisms were connected to railway cars and coupling units.

It thus is an object of the present invention to provide methods and apparatus for effectively controlling "run-in" train action events.

It is a related object of the invention to provide such methods and apparatus which are equally capable of coping with "run-out" train action phenomena.

A further object of the invention is to provide such methods and apparatus which are capable of controlling or minimizing train action phenomena, generally, and also absorb high level impact shocks and also permit restoring mechanisms to rapidly restore coupling units where extraneous forces are not acting upon the coupling units themselves.

It is also an object of the invention to provide a cushioning mechanism characterized by a simplified overall structure and by rugged and effective connections between the mechanism, a coupling bar and a railway car sill.

It is also an object of the invention to provide such an improved coupling mechanism which eliminates altogether the need for special accumulator devices.

In accomplishing certain of the foregoing objects, there is presented, through this invention, a method of controlling train action phenomena wherein an impedance means is provided between relatively movable draft gear cushioning members. The impedance means is operable to impede buff movement of the draft gear.

The term "buff movement," as here used, denotes in the conventional sense, the movement of a coupler bar toward a railway car occasioned by forces such as those generated during coupling operations. "Draft movement" on the other hand indicates outward movement of a coupling bar, i.e., movement of a coupling bar away from its associated railway car in response to pulling forces acting on the coupling bar.

In response to the buff forces acting on the draft gear tending to produce "run-in" train action events, a first level of impedance to movement is provided by the impedance means. In response to buff coupling forces acting on the draft gear, i.e., buff forces generated during coupling operations, a second level of impedance is provided which is substantially less than the first level of impedance.

In a preferred embodiment, this basis method concept is augmented by providing other hydraulic impedance means between the draft gear cushioning members. This other hydraulic impedance means is operable to impede draft movement of railway car draft gear. In response to draft forces acting on the draft gear and tending to provide "run-out" train action events, a relatively high impedance level is provided in the other impedance means. In response to low level draft forces acting on the draft gear, a relatively low impedance level is provided in this other impedance means.

As to each of these method concepts, the invention here presented provides apparatus uniquely capable of effecting their implementation.

The invention also is concerned, in an individually significant manner, with a railway cushioning device characterized by cylinder means and piston means disposed within this cylinder means for telescoping movement. One of the piston means and cylinder means is adapted to be connected with a railway car. The other of the piston and cylinder means is adapted to be connected with a coupling member. A port means or passage means system is operable to impede an outward flow of fluid from the interior of the cylinder means, in response to relative movement between the cylinder means and piston means. The port means is provided with a valve mechanism operable to impede a flow of fluid moving out of the cylinder means in response to buff force induced, relative movement between the piston means and cylinder means. This valve mechanism includes first, valve closing means operable to restrict flow through the port means in response to "run-in" train action events. The valve mechanism additionally includes second disabling means operable in response to buff coupling forces to maintain the port means substantially open. Third, valve biasing means continuously bias the valve mechanism toward a relatively open condition.

Another independently significant aspect of the invention pertains to an apparatus including both inner and outer cylinder means. A piston means is contained within the inner cylinder means. A piston rod means extends from one side only of the piston means and slidably intersects one end only of the inner cylinder means. A body of piston means, movement impeding, fluid fully occupies the inner cylinder means. A cavity means is located between inner and outer cylinder means. Port means in the inner cylinder means provide restricted fluid communication between the cavity means and the interior of the inner cylinder means. A body of air is contained within this cavity means and has a volume at least equal to the volume of the piston rod means operable to move into and out of the interior of the inner cylinder means. This body of air is in direct communication with the piston means movement impeding fluid and operable to intermix therewith.

Other apparatus aspects of the invention pertain to novel connecting means and anchoring means for connecting the cushioning device, respectively, to a coupling bar and a railway car sill.

DRAWINGS

In describing the invention, reference will be made to a preferred embodiment shown in the appended drawings.

In the drawings:

FIG. 1 provides a perspective view of a railway car and components of a cushioning mechanism and a coupling bar, with these components being shown in an "exploded" or separated format;

FIG. 2 provides an enlarged, sectional, elevational view of the cushioning mechanism shown in FIG. 1;

FIG. 3 provides a plan view of the inner cylinder wall of the FIG. 2 cushioning device, with this wall "laid flat."

FIG. 4 provides an enlarged, transverse, sectional view of the FIG. 2 cushioning device as viewed along the section line 4–4 of FIG. 2;

FIG. 5 provides a transverse, sectional and enlarged view of the FIG. 2 cushioning device as viewed along the section line 5–5 of FIG. 2;

FIG. 6 provides a still further enlarged, fragmentary, and partially sectioned perspective view of a connecting portion of the FIG. 1 mechanism, which portion is operable to connect the mechanism with a conventional coupling bar or draft member;

FIG. 7 provides a plan, sectional view of the FIG. 6 connecting mechanism, at a somewhat reduced scale, illustrating the manner in which a coupling key is inserted;

FIG. 8 provides a vertically sectioned view of a modified form of the FIG. 6 connecting mechanism, characterized by the use of a vertically extending coupling pin operable to pivotally interconnect a coupling bar to the FIG. 2 mechanism;

FIG. 9 provides an enlarged, elevational, and sectioned view of a valve mechanism incorporated in the FIG. 2 mechanism, which valve mechanism is operable to control flow through cylinder ports during buff movement of the draft gear, i.e., coupling bar. The valve components are shown in FIG. 9 in their relaxed or normal condition, i.e., with no fluid forces acting on the components;

FIG. 10 illustrates the components of the FIG. 9 assembly as they are disposed during an outflow of fluid from the inner cylinder of the FIG. 2 mechanism so as to control "run-in" train action events;

FIG. 11 illustrates the components of the FIG. 9 assembly as they are disposed during an outflow of fluid from the inner cylinder of the FIG. 2 assembly in response to coupling shock acting on the coupling member;

FIG. 12 provides a transverse sectional view of the FIG. 9 assembly as viewed along the section line 12–12 of FIG. 9;

FIG. 13 provides a transverse sectional view of the FIG. 9 assembly as viewed along the section line 13–13 of FIG. 9;

FIG. 14 provides a transverse sectional view of the FIG. 9 assembly as viewed along the section line 14–14 of FIG. 9;

FIG. 15 provides a bottom plan view of the underside of a railway car sill illustrating details of an anchoring system for securing the piston rod of the FIG. 2 mechanism to the sill;

FIG. 16 provides an enlarged, transversely sectioned, view of a check valve mechanism incorporated in the FIG. 2 mechanism, which check valve mechanism enables fluid to return to the interior of the inner cylinder of this mechanism during draft movement of the coupling bar; and

FIG. 17 provides an enlarged transversely sectioned view of a valve mechanism mounted at the draft end of the inner cylinder of the FIG. 2 mechanism and which serves to control "run-out" train action events.

BASIC STRUCTURE

FIGS. 1 and 2 illustrate the basic components of a cushioning mechanism designed to be incorporated in a railway freight car in conjunction with a conventional drawbar or coupler, conventionally or often termed, or included in the term, "draft gear."

Cushioning mechanism 1 includes cylinder means 2. Cylinder means 2 is connected with a drawbar 15, as subsequently described, and is generally longitudinally movable relative to a railway car 11 or vehicle with which it is associated. This cylinder means comprises an outer cylinder 3 and an inner cylinder 4. A piston means 5 is telescopingly associated with the cylinder means 2. Piston means 5 includes a piston 6 mounted for telescoping movement within the interior cavity 7 of cylinder 4. Piston means 5 includes a piston rod 8 extending from one side only of the piston body 6.

An anchor assembly or anchor means 9 serves to connect the piston means 5 to the sill 10 of a railway car 11. Anchor means 9 comprises a conventional spherical bearing assembly 12 carried at the free extremity of the piston rod 8. This spherical bearing assembly 12 is secured within a unitized precast housing 13. The housing 13 is secured within the sill 10 as, for example, by conventional welding techniques.

A continuation of outer cylinder 3 defines a connecting means 14 which serves to connect the cylinder means 2 with a conventional drawbar 15.

A restoring mechanism 16 provides a resilient interconnection between the sill 10 and a tongue portion 17 of the cylinder means 2. Restoring mechanism 16, fabricated from coil springs, serves to yieldably and resiliently bias the cylinder means 2 to a predetermined neutral or rest position. Restoring mechanism 16 may be of the general type described, for example, in the U.S. Pat. No. 3,233,747 to Abbott et al.

The general manner in which a cushioning mechanism is mounted on a railway car structure is well understood and described, for example, in the U.S. Pat. No. 3,233,747, to Abbott et al. as well as in said U.S. Pat. No. 3,451,561 to Stephenson et al.

Suffice it to say, with reference to FIG. 2, that the cushioning device 1 is mounted within the sill 10, with the piston means 5 fixedly anchored to the sill 10 by way of anchor means 9. The cylinder means 2 is free to undergo longitudinal telescoping movement within the sill 10.

Buff movement of the cylinder means 2 is limited by engagement of collarlike abutment means 18, carried by connecting means 14, with collarlike abutment means 19 carried by the outer end of the sill 10. Draft movement of the cylinder means 2 is limited by engagement of the piston means 6 with an annular check valve member 20 defining the draft end of cylinder space 7.

Restoring mechanism 16 is connected, at one end, by bracket means 21 to a sill base plate 22. Sill plate 22 is fixedly connected to the underside of sill 10 so as to provide support for the underside of cylinder means 2.

Another portion of restoring mechanism 16 is connected with the tongue portion 17 of cylinder means 2.

The coil spring components of restoring mechanism 16 tend to yieldably bias the cylinder means 2 toward a predetermined neutral position as described in detail in the aforesaid U.S. Pat. No. 3,233,747 to Abbott et al. In connection with this invention, the predetermined neutral position is the position at which the piston means 6 engages the draft extremity of cylinder space 7, i.e., the check valve 20. Thus, referring to FIG. 2, the piston means 6 as shown in full line, is disposed substantially in its full buff condition, with the draft side 6a of piston means 6 substantially displaced from the check valve 20. The phantom line 6a' shown in FIG. 2 depicts the neutral position of the draft face 6a of the piston means 6, this position also constituting the fully extended or draft condition of the cushioning mechanism as heretofore noted.

It will here be recognized that with this neutral position, the restoring mechanism 16 need not have a capacity to restore in a buff direction. It is necessary only for the restoring mechanism to return the cylinder means 2 from the full buff position illustrated in FIG. 2, in a draft direction, to the neutral position. Thus, if desired, the structure of the restoring mechanism described in the Abbott et al. patent may be simplified to eliminate the ability of the Abbott et al. restoring mechanism to resiliently bias the cylinder means 2 in a buff direction.

CYLINDER STRUCTURE

As noted, one cushioning member or cylinder means 2 includes outer cylinder 3 and inner cylinder 4. Outer cylinder means 3, as shown in FIGS. 2, 4 and 5, has a generally rectangular cross-sectional configuration.

Inner cylinder 4, which is contained within and spaced from the outer cylinder 3, has a generally cylindrical or circular cross section.

Cylinder 4 is spaced from cylinder 3 so as to provide a generally annular, low pressure cavity 23. Because of the relatively low pressure nature of the fluid contained within this cavity, the sidewall 24 of cylinder 3 may be relatively thin in relation to the sidewall 25 of cylinder 4. Cylinder 4 contains the high pressure cavity 7.

The ends of cylinder means 3 and 4, adjacent anchor means 9, may be termed "first" cylinder ends. The first end of outer cylinder means 3 is defined by a cylinder head 26. The first end of inner cylinder means 4 is defined by a cylinder head 27. Cylinder heads 26 and 27 are both centrally apertured to telescopingly receive the piston rod 8.

A bushing 28 provides a bearing relationship between the cylinder head 27 and piston rod 8. An assembly 29 of conventional annular seals is provided in cylinder head 26 to maintain a sealed relationship between the cylinder head 26 and the reciprocable piston rod 8.

It is here significant to note that the seal mechanism 29 is disposed in an annular recess 29a formed in cylinder head 26. Recess 29a faces outwardly so as to provide access to the seal assembly 29 from the exterior of the unit. Seal assembly 29 may be retained in place in recess 29a by an annular cover plate 29b. Plate 29b may be secured in place by conventional threaded fasteners, as shown in FIG. 2.

An accordianlike elastomeric dust shield 30 is connected at one end 31 to cylinder head 26 and the other end 32 to piston rod 8. This dust shield structure protects the portion of the piston rod 8 which reciprocates into and out of the cylinder means 2.

As shown in FIG. 2, cylinder head 27 is stabilized by cylinder head 26. This support is achieved by a plurality of circumferentially spaced and radially directed webs 33 extending longitudinally between the cylinder heads 26 and 27. As illustrated, the longitudinal spacing of cylinder heads 26 and 27 and the circumferential spacing of the webs 33 provides passage means 34 defining a continuation of the low pressure cavity 23. This passage means 34 communicates with the rightmost end of cylinder head 27, viewing the apparatus as shown in FIG. 2.

The end of cylinder means 2 disposed adjacent connecting means 14 may be termed the "second" cylinder head or "-second" cylinder end.

Thus, the second end of cylinder means 3 is closed by generally annular, second cylinder head means 35. The second end of inner cylinder means 4 is closed by second cylinder head means 36.

As illustrated, cylinder head means 35 and 36, in essence, are defined by an integral wall extending entirely across the second end of cylinder means 2.

Inner cylinder wall means 25 may be mounted in an interfering fit relationship on an annular ledgelike portion 37 of the unitary wall means 38 which provides cylinder head means 35 and 36. A similar mounting arrangement interconnects wall 25 with cylinder head 27.

Port means 39 provide communication between the high pressure cylinder cavity 7 and the low pressure cylinder cavity 23. For purposes of convenience of illustration, all of the ports of port means 39 are illustrated in FIG. 2 as though they were aligned with the median longitudinal plane of the cylinder wall 25. It will be understood, however, that the actual disposition of these ports is more accurately reflected in FIG. 3.

During buff movement of the cylinder means 2, the cylinder head wall 36 moves toward the leftmost side of piston means 6, viewing the apparatus as shown in FIG. 2, so as to expel fluid from the cylinder cavity portion 7a into the low pressure zone 23. Fluid expelled from the cavity 7a enters the low pressure zone 23 and flows into the passage means 34. This fluid is returned to the cylinder zone 7b, disposed between the rightmost side of piston 6 and the cylinder head 27, by way of a check valve 20.

Check valve 20 comprises a generally annular valving plate 20d mounted on cylinder head 27 within cavity 7. Plate 20a is valvingly associated with a plurality of longitudinally extending and circumferentially spaced, high capacity passages 40 formed in cylinder head 27. A series of circumferentially spaced coil spring units 41 serve to yieldably and resiliently bias the plate 20a toward anchor means 9, into passage closing relationship with the passage means 40. Each such biasing mechanism 41 comprises a coil spring 42 interposed between an abutment 43, carried by valve plate 20a by way of a rod 44, and an abutment 45 formed in a cylinder head passage 46.

The structure and mode of operation of this check valve mechanism is described in detail, for example, in the U.S. Pat. No. 2,944,681 to Blake. For present purposes, it is sufficient to note that fluid expelled from space 7a and transmitted to the area of passage means 34 returns to the cylinder cavity 7b as a result of the opening of check valve 20.

During draft movement of cylinder means 2, subsequent to a prior buff movement the cylinder head 27 moves toward the right side of piston 6 viewing the apparatus as shown in FIG. 2. During this draft movement of cylinder means 2, fluid will be expelled from the cavity 7b through the port means 39 and flow into the low pressure zone 23.

This fluid expelled from cavity 7b will return to cavity 7a by way of a first port 47 in port means 39. Port 47 is disposed in the underside of cylinder wall 25 and provides fluid communication between the cavities 7a and 23 throughout the extent of draft travel of the cylinder means 2.

A check valve mechanism 48, illustrated in detail in FIG. 16, provides continuously, check valve controlled communication between the cavity 7*a* and the cavity 23. The flow capacity of the port means 47, when placed in an open condition by check valve 48 is of a relatively high magnitude, so as to afford nominal resistance to return flow of fluid from low pressure cavity 23 through the zone 7*a*.

Structural details of the check valve mechanism 48 are shown in FIG. 16. As there shown, mechanism 48 comprises a body 49 connected by threaded coupling means 50 to the exterior of wall 25. A valve member 51 is telescopingly mounted within valve body 49.

Valve member 51 is generally cylindrical in character and includes a cylindrical sidewall 52 provided with a plurality of radial ports 53. An imperforate head wall 54, connected with sidewall 52, provides a sealing surface 55 to sealingly engage a valve seat 56 formed on valve body 49. A coil spring 57 interposed between valve member carried abutment 58 and a valve body carried abutment 59 serves to yieldably bias the valve member 51 to a closed position.

In response to a relatively low pressure in cavity 7*a*, resulting from draft movement of cylinder means 2, subsequent to a prior buff movement, the valve 51 will automatically open so as to allow the return flow of fluid from cavity 23 into the zone 7*a*.

PISTON MEANS AND ANCHOR STRUCTURE

The structure of piston means 5 and anchor means 9 is illustrated in FIGS. 2 and 15.

Piston means i.e. another cushioning member connected with car 11, 5 includes the piston 6. A bushing 60 is supported in an annular, notchlike recess 61 formed on the outer cylindrical periphery of piston 6. Bushing 60 may be secured in place by an annular plate 62 secured to piston body 6 by threaded fastener 63. A generally annular sealing element 64 is carried on the outer periphery of bushing 60 and provides sliding and substantially sealing engagement between the outer periphery of the piston 6 and the inner periphery of wall 25 of cylinder means 4. Element 64 may comprise a "split" piston ring operable to provide highly limited leakage between zones 7*a* and 7*b*, as described in the aforesaid Stephenson application.

Piston rod 8 extends from one side only of piston body 6 and intersects the first ends only of cylinder means 3 and 4. Thus, piston 6 is supported in a cantilever fashion within cylinder means 4, with there being no piston rod extending into the cavity portion 7*a* or through the second cylinder end plate 38.

Piston rod 8 is sealingly and slidably supported during its reciprocable passage through cylinder heads 27 and 26 by bushing 28 and seal means 29.

The free, or rightmost extremity of piston rod 8 terminates in the spherical bearing assembly 12. This spherical bearing assembly 12 is of the type described, for example, in the aforesaid U.S. Pat. No. 2,944,681.

For present purposes, it is sufficient to note that this spherical bearing assembly, which serves to accommodate nonaxially directed stress, comprises a headlike portion 65 providing arcuate spherical segment surfaces 66 and 67. A bearing plate 68 conformingly engages surface 66 while another bearing plate 69 conformingly engages surface 67. Plates 68 and 69 are interconnected as described generally in the aforesaid Blake U.S. Pat. No. 2,944,681.

Unitized housing 13 of anchor means 9 comprises a pair of sidewalls 70 and 71. These walls extend longitudinally of the sidewalls 72 and 73 of sill 10. Housing sidewalls 70 and 71 may be welded to sill sidewalls 72 and 73 respectively.

Housing sidewalls 70 and 71 are interconnected by a pair of longitudinally spaced, and transversely extending, walls 74 and 75. Wall 75 is provided with an aperture 76 of a size sufficient to receive the spherical bearing assembly 12.

With spherical bearing assembly 12 inserted through the aperture 76 of the welded-in-place housing 13, it will be positioned such that the late 69 abuttingly engages an abutment or stop portion 74*a* carried by the transverse wall 74 of housing means 13.

With the spherical bearing assembly 12 thus disposed in abutting engagement with the stop 74*a*, the assembly 12 may be fixed in position relative to the housing 13 by inserting a securing plate 77. Securing plate 77, as shown in FIG. 1, is U-shaped and includes a pair of laterally spaced legs 78 and 79. Plate 77 is installed through the open underside 80 of housing 13 so as to straddle the piston rod 8, with the legs 78 and 79 disposed on opposite lateral sides of the piston rod 8. The width of the plate 77 is such that when it is disposed in this straddling position, it bridges the longitudinal clearance between plate 68 and the housing wall 75, assuming, of course, that plate 69 is abuttingly engaged with the stop 74*a*. With anchor plate 77 thus positioned, it may be secured in place by conventional threaded fasteners 81 which pass transversely through the housing wall 75 and the lower wall portion 82 of plate 77 which connects the legs 78 and 79.

HYDRAULIC FLUID SYSTEM

When the cushioning mechanism 1 is assembled, oil may be introduced into the cavity 7 through conventional filling orifices (not shown). Oil is introduced when the piston 6 is in the full buff position shown in FIG. 2. The volume of oil is adjusted so as to fill the total void space of cavities 7*a*, 7*b*, 23 and 34, except for a volume equal to one-half of the volume of piston rod 8 which reciprocates into and out of the cavity 7, i.e. the change in volume of cavity 7 caused by reciprocation of piston rod 8.

This degree of filling will leave, in the total void space of cylinder means 2, when the piston is in the full buff or contracted position, a void or air space equal to one-half of the piston rod volume which reciprocates into and out of the cavity 7. At the other extremity of piston movement, i.e. when the cylinder is in the extended or draft position, this void space will be equal to one and one-half times the piston rod volume which moves into and out of the cavity 7.

Even at the draft position of cylinder means 2, (indicated by phantom line 6*a'* of FIG. 2 identifying the draft position of piston face 6*a*) the air void, which comprises an air body in direct communication with the hydraulic oil of the system, will exist only in the top of cavity 23 and above the cavity 7. Thus, the free air or void space will not extend into the hydraulic impedance zone 7.

Nevertheless, this air, being in direct contact with the oil body, will be capable of intermixing with the oil as relative movement between the piston means 5 and cylinder means 2 occurs. It has been found, quite unexpectedly, that this intermixing, which may produce air bubbles within the oil contained in cavity 7, does not deleteriously affect the ability of the oil in cavity 7 to control train action events and absorb the high impact shocks.

This air void will provide an effective mechanism for accommodating the expansion of oil which results from oil heating during shock absorbing action.

Somewhat surprisingly, it has been found that the air void may be reduced to the point where virtually no air exists in the system when the cylinder is in the full buff position shown in FIG. 2. Even under this condition the system will still accommodate the thermally induced expansion of the hydraulic oil.

"RUN-IN" AND BUFF SHOCK CONTROL SYSTEM

The impedance to coupler bar movement during buff movement of cylinder means 2 is controlled by a plurality of exponentially spaced ports 83 through 94 included in the port series 39.

These exponentially spaced ports are arranged on cylinder wall 25, generally as shown in FIG. 3.

FIG. 3 represents cylinder wall 25, separated at median and longitudinally extending line 26, and laid flat. Line 26 represents the intersection of the longitudinally extending vertical median plane passing through the cylinder means 4 with the upper portion of wall **25**. The general location of line **26** is shown in FIGS. **4** and **5**.

The exponential spacing herein-referred to corresponds generally to that described, for example, in the U.S. patent No. 3,301,410 to Seay and described also in the previously noted application Ser. No. 610,553 to Stephenson et al.

In one embodiment of the invention, where the piston **6** is operable to reciprocate longitudinally within cavity **7** through an increment of about 15 inches, and where the inner diameter of cylinder wall **25** is approximately 8 inches, and where piston rod **8** has a diameter of approximately 3¼ inches, the exponentially spaced ports **83** through **94** are spaced from the cylinder end **95**, in a direction measured longitudinally or parallel to the junction **26**, in general accordance with the following tabulation:

Port:	Distance in inches from cylinder end 95
83	2.0
84	2.14
85	2.44
86	2.84
87	3.35
88	4.00
89	4.84
90	5.97
91	7.37
92	9.25
93	11.32
94	13.90

All of the passage means or ports **83** through **94**, in the embodiment characterized by the dimensions above-noted, are of the same diameter, i.e. nineteen sixty-fourths inches.

In this embodiment the longitudinal width of the piston **6**, i.e. the distance between piston sides *6a* and *6b*, is approximately two and one-half inches.

In the full buff position of piston **6**, this piston covers ports **83** through **88**. Each of these six ports adjacent cylinder end **95** are individually controlled by a control valve **96**. Thus, ports **89** through **94** are continuously open and unvalved, while ports **83** through **88** are each under the control of an individual valve **96**.

In order to facilitate the overall illustration of the invention, the various valve mechanisms **96** associated with the ports **83** through **88** of port system **39** are not shown in FIG. **2**. However, the positioned relationship of valves **96** are shown in FIGS. **3**, **4** and **5**.

Structural details of a representative control valve **96** are illustrated in FIGS. **9** through **14**. As there shown, the control valve **96** comprises a generally cylindrical body **97**. A threaded coupling **98** serves to threadably secure the valve **96** to the exterior of the wall **25** in a radially extending alignment with respect to the central axis of the cylinder means **4** and in coaxial disposition with its associated port. The valve **96**, illustrated in FIGS. **9** through **14**, is shown in association with the first port **83** in the exponential series.

As shown in FIGS. **4** and **5**, the various valves **96** are arranged so as to project into the enlarged corner portions of the generally annular cavity **23**, where maximum space is available.

Returning to the basic structure of valve **96**, each valve includes a reciprocable, generally cylindrical, spool valve member **99**. Each such spool valve member includes a generally cylindrical body portion **100** having a closed, radially outermost, extremity **101**. A plurality of radially extending ports **102** intersect the cylindrical wall portion **100**, immediately beneath the end wall **101**. In the embodiment characterized by the dimensions above-noted, four ports **102** are provided, each having a diameter of eleven sixty-fourths inches.

The end **103** of valve **99**, facing the central axis of the cylinder means **4**, is open as shown in FIG. **9**.

Each reciprocable valve further includes a generally annular rimlike piston **104** which may be termed, or included in the term, "valve closing means". This piston extends radially outwardly from cylinder wall **100**, generally adjacent the free end **103**.

A second series of radially extending and circumferentially spaced ports **105** intersects cylinder wall **100** adjacent piston **104**.

An annular shoulder or ledge **106** is formed on the outer periphery of cylindrical wall **100**. Ledge **106** faces generally axially, toward the head portion **101** of valve **99**.

A valve body cap **107** closes the outermost end of the valve body **97** and telescopingly receives the cylindrical wall **100**. As illustrated, closure or cap **107** may be disclike in structure. Closure **107** is provided with a central aperture **108** through which cylindrical wall portion **100** reciprocates.

Closure **107** provides an annular abutment **109**, extending radially outwardly from a cylindrical cap surface **110**, which surface defines aperture **108**. With abutment **106** engaged with abutment **109**, the main valve ports **102** are positioned so as to clear, i.e. be spaced outwardly from, the outer extremity **111** of closure **107**.

Valve **99** is biased outwardly of the central axis of cylinder means **4** so as to bring the abutment **106** into engagement with abutment **109** by a coil spring **112**. This spring **112** abuttingly engages an annular recess or seat **113** formed in the free end **103** of the valve wall **100**.

As shown in FIG. **9**, closure **107** cooperates with a radially extending valve body wall **114** and a cylindrical body wall **115** to define a generally annular cylinderlike cavity **116**. Valve piston **104** is operable to reciprocate through cavity **116**.

Port means **105** provide, by way of port **83**, fluid communication between the high pressure cavity **7** and the zone **116*a*** of cavity **116** which is disposed between the closure **107** and the piston **104**.

A plurality of ports **117** intersect the generally hexagonal base wall **118** of valve body **97**, immediately adjacent, but radially outwardly of, the cylinder end wall **114**. Port means **117** thus serve to provide fluid communication between the low pressure cavity **23** and the portion **116*b*** of cylinder cavity **116** disposed between piston **104** and valve body wall **114**.

Thus, piston **104** is biased inwardly toward the central axis of piston means **4** by the pressure of fluid within the cavity **7**. Piston **104** is biased radially outwardly, away from the central axis of cylinder means **4**, by a generally low pressure fluid within cavity **23**.

Thus, when the higher pressure of fluid within cavity **7**, acting through port means **105** on piston **104**, overcomes both the spring biasing of spring **112**, and the fluid pressure of cavity **23** transmitted through ports **117** to piston **104**, the valve **97** will move radially inwardly to a closed valve position, i.e. the position shown in FIG. **10**. In this closed valve position, the ports **102** are covered and substantially closed by surface **110**. Surface **110** is disposed in generally telescoping and conforming relation with the outer periphery **119** of valve wall **100**.

In this connection, however, it will be understood that the relationship between outer periphery **119** of valve **96** and surface **110** may not be such as to provide complete sealing, i.e., some limited leakage may take place. Indeed, in the embodiment characterized by the dimensional criteria above-indicated, with the valve disposed in the FIG. **10** position, a degree of leakage through the valve takes place which is on the order of one-tenth of the flow permitted by the valve in the open position shown in FIG. **9**.

It will here be understood that the reaction surface **104*a*** provided by the piston **104** in the zone **116*a*** is sufficient to provide a net downward biasing operable to overcome both the biasing influence of spring **112**, the biasing of fluid pressure in the zone **116*b***, and any biasing acting outwardly on the valve **99** as a result of a restricted flow through the ports **102**.

The restoring or biasing force of spring **112** is of a relatively low magnitude such that the valve member **97** will move to the closed valve position during any "run-in" train action phenomena. This results because the low velocity of piston **6** during "run-in" events is sufficient to generate enough pressure in cavity 7 and cavity 116*a* to induce closing movement of valve 99.

It is contemplated that, in some circumstances, the restoring mechanism 16 may serve to position the piston 6 at a neutral position where the piston 6 would be spaced from its extremity of draft movement, i.e. a neutral position where piston face 6*a* would be spaced from the phantom line position 6*a'* shown in FIG. 2. Under such circumstances, where the restoring mechanism 16 is imposing very low level forces on the piston 16 tending to restore the piston 16 from a full draft position to an intermediate neutral position, the spring 112 will overcome the pressure effects of fluid within the cavity 7, transmitted through the port means 105 and acting on the piston 104, so as to hold the valve 99 in the open position shown in FIG. 9. With the valve 99 thus held open during the restoring action, relatively rapid restoration will be assured.

Valve mechanism 96 includes a unique disabling device 120 which serves to maintain the valve 97 in an open position when the coupler bar 15 and cylinder means 2 are subjected to impact forces of the type encountered during coupling operations. Such operations ordinarily occur in railway yards where trains are being assembled and one car is moved into engagement with another with sufficient force to induce interlatching of the coupler bars of the two cars involved.

Because of the severity of such coupler forces, it is highly desirable to maintain an immediately effective low level of impedance in the unit 1, operable to dissipate impact energy in a generally uniform manner and without excessively stressing the cylinder components of the mechanism. This low level of impedance is in contrast to the high level of impedance previously described which is attained during "run-in" phenomena. The high level of impedance during "run-in" phenomena is necessary in order to impede coupler movements where the level of forces acting on the coupler units is relatively low in comparison to those encountered during coupling operations.

The low level of impedance effected by the valve mechanism 96 will now be described with relation to FIGS. 9 and 11.

Disabling mechanism 120 comprises a sleeve 121 mounted for telescoping movement within the valve member 99. As shown, sleeve 121 is generally cylindrical in configuration and has an open upper end 122 as well as an open lower end 123. Ends 122 and 123 are connected by a relatively thin walled, or recessed, cylindrical wall portion 124.

Upper end 122 is telescopingly and slidably supported by cylindrical wall portion 125 of valve 99. The lower end 123 of sleeve 121 is telescopingly and slidably supported by a cylindrical wall portion 126 formed in the valve body 97.

Sleeve 121 is provided with a radially outwardly extending, ledgelike flange 127. Flange 127 defines an abutment which engages the end 128 of coil spring 112, i.e. the end of this spring opposite to the end 129 which is engaged by the seat 113.

In the normal or neutral position of valve 96 shown in FIG. 9, the spring 112 biases the flange 127 radially inwardly toward the axis of cylinder means 4 so as to cause the flange 127 to abuttingly engage an annular seat 129 formed in the valve body 97. With the flange 127 engaged with the seat 129, the spring 112 is operable to resist radially inward movement of the valve member 99.

The biasing effect of spring 112, both with respect to sleeve 121 and valve member 99, may be varied by selecting a spring 112 of appropriate resilience. This biasing effect may also be varied in accordance with the degree of spring prestressing which is dependent upon the distance between the seat 113 and the ledge 127, when this ledge is engaged with the abutment 129.

The diameter of the port 83 is less than the outer diameter of the sleeve end 123. Thus, if the ledge 127 should rupture, radially inward movement of the sleeve 121 would be interrupted by engagement of the sleeve end 123 with the portion 130 of cylinder wall 25 which surrounds the port 83. In this manner, inadvertent entry of the sleeve 120 into the high pressure cavity 7 is positively prevented.

When the coupler bar 15 is subjected to coupling forces or impacts, there will be a tendency for the piston 6 to move relatively rapidly within the cylinder cavity 7. This tendency to undergo rapid movement will generate a high pressure within the cavity zone 7*a* and tend to induce a relatively high velocity fluid flow, radially outwardly through the central passage 131 of the sleeve 121. This fluid flow, because of its relatively high velocity, will produce a substantial pressure drop longitudinally across the sleeve 121. This pressure drop will overcome the biasing influence of the spring 112 and cause the sleeve 121 to move radially outwardly with respect to the longitudinal axis of the cylinder means 4.

The outward movement of sleeve 121 will terminate when the outermost sleeve end 122 engages an annular abutment 132 formed in valve member 99. Abutment 132 comprises a generally radially extending wall projecting outwardly from a cylindrical wall 133. Cylindrical wall 133, in essence, defines the inner surface of wall 100.

With the sleeve end 122 engaged with the abutment 132, this sleeve end 122 is operable to close the ports 105, i.e. substantially isolate piston 104 from fluid flowing through passage means 83 as shown in FIG. 11. With the ports 105 thus closed, the ability of the piston 104 to move the valve member 99 to a closed valve position is obviated.

Sleeve 121 is characterized by a substantially lower inertia factor than that possessed by the valve 99. This difference in inertia will tend to cause the sleeve 121 to move relatively rapidly to the FIG. 11 position, before fluid pressure is able to build up in the zone 116*a* and induce movement of the piston 104. Further, a high velocity flow through the passage 134, and through the central passage of the valve member 99, will tend to create a velocity reaction force acting on the valve head 101 so as to tend to hold the valve member 99 in its open position while the sleeve 121 is moving to its disabling position.

So long as there is a relatively high velocity flow through the passage means 131 in response to the imposition of high impact forces acting on the coupler bar 15, the sleeve 121 will remain in the position shown in FIG. 11 so as to close the ports 105 and disable the piston 104. With the piston 104 thus disabled, the relatively high velocity flow through the passage 131, resulting from the impact forces, will exert a velocity reaction force on the end wall 101 of the valve member 99, thereby further tending to maintain the valve 99 in its open position.

Once the valve 99 has moved to a closed valve position, it is unlikely that the sleeve 121 will be able to move radially outwardly to close the ports 105 so as to obviate the biasing influence of piston 104. The closing of ports 102 will probably prevent a flow of sufficient velocity through the passage 134 to induce movement of the sleeve 121. This valve characteristic, however, is not believed to be of adverse consequence because during "run-in" phenomena, train action forces would not be expected to approach the magnitude of coupling forces so as to require that the ports 102 remain open.

It will here be noted that with the valve components disposed as shown in FIG. 11, the wall 133 defines a substantially smooth-walled continuation of the inner wall 134 of sleeve 121. This results, of course, from walls 133 and 134 having the same circular cross section, i.e. the same internal diameter.

It will here be recognized, that the level of impact forces required to induce the disabling operation of the sleeve 121 will be determined, to a large extent, by the resistance to sleeve movement offered by the coil spring 112.

Where each of the valves 96 associated with the ports 83 through 88 is identical in structure, and includes a coil spring 112 of identical configuration and resilience, the various disabling sleeves 121 should operate in unison, and immediately in response to the imposition of coupling forces on the drawbar 15.

This will ensure that the exponential pattern of the ports 83 through 94 remains fully operative during the high impact condition so as to facilitate or contribute to a substantially linear disposition of energy in the manner described in U.S. Pat. No. 3,301,410 to Seay.

At this point it will be recognized that even the lower level impact forces encountered during coupling action will be sufficient to induce the disabling operation of the sleeves **121** of the various valves **96** individually associated with the ports **83** through **88**. This results because, even under the influence of relatively low impact coupling forces, the flow velocity through the passage **134** will be substantially higher than that encountered during "run-in" train action phenomena, and thus will be operable to move the sleeve **121** to the disabling position shown in FIG. **11**.

In the system here described, it is contemplated that each of the valves **96** will be of identical configuration and operating characteristics. Thus, during "run-in" phenomena, each of the valves **96** associated individually with the ports **83** through **88** should close more or less simultaneously, in response to "run-in" phenomena.

However, it is recognized that under certain conditions it may be desirable to provide valves **96** which operate in sequence or at different times so as to provide progressive closing off or constricting of the ports.

It will also be recognized that the number of ports required to control "run-in" phenomena may vary, depending upon operating conditions, and that the number of these ports which are valved may vary, depending upon operating criteria.

SYSTEM FOR CONTROLLING "RUN-OUT" PHENOMENA

The system incorporated in mechanism **1** for controlling "run-out" phenomena is illustrated in FIGS. **2** and **17**.

This system includes, as a part of the port means **39**, a relatively small capacity port **135** and a somewhat larger capacity port **136**, provided with a control valve mechanism **137**.

In the embodiment characterized by the dimensions previously indicated, the port **135** has an effective diameter of approximately 0.099 inch and the port **136** has a diameter of nineteen sixty-fourths inches. However, fluid flow through port **136** is controlled by the substantially small flow capacity of the passage means of valve **137**.

In this embodiment, the port **135** is spaced longitudinally from the edge **95** by a distance of approximately 16.62 inches. The port **136** is spaced from the edge **95** by a distance of approximately 19.72 inches.

Valve mechanism **137**, as shown in FIGS. **17** and **5**, is disposed in a lower corner of cavity **23**. Control valve **137** is substantially the same as the "run-out" control valve described in detail in the aforesaid U.S. Pat. No. 3,451,561 to Stephenson et al.

In summary, this control valve **137** is characterized by a generally cylindrical valve body **138**. Valve body **138** is attached by threaded fastening means **139** to wall **25**. When thus attached, valve body **138** extends generally coaxially of port **136**, i.e. radially of the central axis of cylinder means **4**.

Control valve **137** includes a generally cylindrical valve member **140** mounted for telescoping movement within valve body **138**. A coil spring **141**, interposed between a valve body ledge **142** and a flange **143** carried by valve **140**, serves to bias the valve member **140** radially inwardly with respect to the cylinder means **4**. Inward movement of valve member **140** is limited by engagement of the flange **143** with a valve body ledge **144**.

Valve member **140** is defined by a cylindrical wall **145** having an open upper end **146** and a closed lower end **147**. One or more ports **148** intersect cylindrical wall **145** immediately adjacent the closed end **147**.

With the valve member **140** disposed in the neutral position shown in FIG. **6**, the flow controlling port means **148** is disposed in communicating relation with the cavity **7*b***. When the valve member **140** is moved radially outwardly, by overcoming the biasing influence of spring **141**, a cylindrical wall **149** of valve body **138** "valves-off" or closes the port means **148**.

During "run-out" train action phenomena, fluid flowing from the cavity **7*b***, through the port means **148**, and thence through the valve passage **150**, to the low pressure zone **23** will induce, i.e. insure or maintain, a substantial pressure drop across the closed valve head **147**. This pressure differential may also be viewed as resulting, at least in part, from the difference in pressure between the zone **7*b*** and the zone **23**, resulting from movement of piston **6**.

Regardless of the manner in which the pressure differential is explained, its existence will serve to induce radially outwardly movement of the valve **140** in response to "run-out" train action phenomena. This valve closing action will close off the port means **136**, and thus provide a relatively high level of impedance operating against the piston **6** during "run-out" train action events.

When the restoring mechanism **16** is tending to move the cylinder means **2** in a draft direction, i.e. restore the unit from a buff condition, the pressure differential acting across the valve **140** will not be sufficient to overcome the biasing influence of the spring **141**. Thus, the valve **137** will remain open during the restoring action of mechanism **16** so as to provide a relatively low level of impedance operating against the piston **6** during this restoring action. This relatively low level of impedance will tend to ensure that the mechanism **16** is operable to effect rapid restoration of the cylinder means **2** to its neutral position.

It will also be appreciated that during "run-out" train action phenomena, once the piston means **6** has "moved" relative to the cylinder wall **25**, so as to have "cleared" the series of exponential ports **83** through **94**, an abrupt intensification of impedance will result because of the highly constricted nature of the port **135** and the closing of the port **136** by the valve **137**. This impedance is further intensified when the piston **6** has "moved" relative to the cylinder wall **25** so as to have moved past the port **135**. Once the port **135** has been "cleared", virtually the only flow out of the cavity **7*b*** will be effected by leakage through the closed valve **137**, by leakage around piston **6** between the cavities **7*a*** and **7*b***, and by other highly constricted leakage paths.

OVERALL MODE OF OPERATION OF IMPEDANCE SYSTEM

During coupling action, the disabling means **120** of the valve mechanism **96** will maintain the ports **83** through **88** in an open condition. This will result in the entire series of exponentially spaced ports **83** through **94** remaining open. These open ports will yield a substantially or generally linear dissipation of impact energy, with a relatively low impedance level present in cavity **7*a***.

Once coupling has been effected, with the cars involved being at a substantial standstill, relatively rapid restoration of the unit **1** is effected by mechanism **16** as a result of the control valve **137** remaining open.

With a train in motion, "run-in" events are controlled by all or some of the ports **83** through **94**, and **135**. The port **136** will play little or no part in the control of "run-in" phenomena since this port will be covered by the piston **6** when the cylinder means **2** is in the extreme draft position.

Of this group of ports, **83** through **94**, and **135**, those disposed between the piston face **6*b*** and the cylinder head **38** during a "run-in" event will control the impeding of piston movement. This impedance will be of a relatively high magnitude as a result of the closing of the valves **96** in response to "run-in" induced forces.

During "run-out" train action events, it is anticipated that the ports **135** and **136** will play the primary governing role. In this connection, it will be recalled that the neutral position for the mechanism **1** positions the piston face **6*a*** in juxtaposition with the draft extremity **20** of the cavity **7**. It thus is anticipated that the slack developed as a result of train movements will position the piston means **6** in an intermediate position within the cavity where impedance is controlled by the ports **135** and **136**. However, it is apparent that some of the ports **89** through **94** in the exponential series may play a role in this impedance if they are located between the piston face 6*a* and the piston extremity 20 during the "run-out" event.

Regardless of the position of the piston at the commencement of the "run-out" event, the piston will move relatively rapidly to a position where control is influenced by the ports 135 and 136. At least by this point in time, the pressure within the zone 7*b* will be sufficient to close the valve 137 and create a high hydraulic impedance within the cavity 7*b*, operable to resist draft movement of the cylinder means 2.

Thus, during "run-out" events, if the piston 6 commences movement from the full buff position shown in FIG. 2, three stages of progressively intensifying impedance will develop in the cavity 7*b*. During the first stage, at least some of the ports in the exponential series will provide escape paths for fluid and thus provide the lowest level of impedance in this three-stage phenomena. As draft movement of the cylinder means 2 continues, the piston 6 will move through the exponential series and then be controlled, in the second impedance stage, by the port 135 and the port 136. It is contemplated by the time the piston 6 clears the exponential series, the valve 137 will have closed the port 136. Thus, during this second stage, the relatively restricted escape path provided by the port 135 will afford a higher impedance level.

Continued draft movement of the cylinder means 2 will cause the piston 6 to clear or move past the port 135 so that, in essence, system leakage or bypassing provides the only escape for fluid from the cavity 7*b*. This leakage or bypassing will provide the third or highest level of impedance during the "run-out" event.

STRUCTURE FOR CONNECTING CUSHIONING MECHANISM WITH DRAWBAR

FIGS. 1, 2, 6 and 7 illustrate one novel structural arrangement for interconnecting a drawbar 15 and a mechanism 1 in a uniquely simplified fashion.

This connecting means embodiment includes laterally spaced and vertically extending sidewall portions 151 and 152 of connecting means 14. Sidewall 151 is provided with a recess 153 operable to abuttingly and conformingly receive one end 154 of a draft key 155. With end 154 received within recess 153, this end of the draft key 155 is effectively supported and prevented from undergoing either longitudinal or vertical movement.

Wall 152 is provided with an aperture 156, conforming in general configuration to the cross section of the median portion of the key 155. Thus, aperture 156, as shown in FIG. 7, provides an entry through which key 155 may be inserted so as to move the key end 154 into engagement with the recess 153.

Recess 153 may be provided with an apertured portion or window 157 so as to enable an operator to observe the positioning of the key end 154 in the recess 153. Where such a window 157 is provided, a wall portion 158 will remain effective to prevent movement of the key 155 through the wall 151.

With the key end 154 seated in the recess 153, the structure of connecting means 14, defining the recess 153 and the aperture 156, will substantially conformingly and supportingly engage the key ends 154 and 159 so as to prevent both longitudinal and vertical movement of these key ends.

Key end 159 is provided with a corner notch 160. A latch 161 is mounted on a pivot pin 162 on the inner side of the wall 152. In order to effect the entry of the key 155 into the aperture 156, it is necessary to swing the latch 161 in a counterclockwise direction, viewing the apparatus, as shown in FIG. 6, out of the path of key end 154. Once the key has been fully inserted, the latch 161 will pivot, by gravity, into the notch 160 so as to secure the key 155 in place. This securing may be further implemented by the provision of a locking pin 163. This pin 163 passes from the outside of wall 152, through the wall 152, and through a securing aperture 164 in the lower end of the latch member 161.

It will be understood, of course, that prior to the insertion of the key 155, the drawbar will be inserted into a recess portion 164 of the connecting means 14 so as to align a key slot 165 with the recess 153 and the aperture 156. With the slots 165, recess 153, and aperture 156 thus aligned, the key 155 may be passed consecutively through the aperture 156, slot 165, and recess 153, so as to interconnect the drawbar 15 with the cylinder means 2.

In this connection it will be understood that the key 155 serves to permit lateral or swinging movement of the drawbar 15 in a conventional fashion. This pivot movement results from conventional clearances between the slot 165 and the key 155, with curved, convex surfaces defining the forward and leading edges of the slot 165.

Disconnection of the drawbar 15 may be effected by removing the locking pin 163 and employing an appropriate tool, such as a screwdriver, to move the latch 161 out of locking engagement with notch 160. In this connection, it will be appreciated that the aperture 156 will provide access to the latch 161 for this purpose.

In certain types of coupling mechanisms, the drawbar 15 will be provided with a vertically extending pin receiving aperture 167. This aperture 167 is shown in FIG. 1, embodied in the shank portion 168 of coupling bar 15. It will be understood, however, that the coupling bar 15 would ordinarily be provided with either the vertically extending aperture 167 or the slot 165, depending upon the nature of the drawbar.

Where the drawbar 15 includes the vertically extending, pin receiving aperture 167, the connecting means 14 will be characterized by a connecting structure as shown in FIG. 8.

As there shown, this connecting structure is characterized by a longitudinally and horizontally extending, top wall 169, and a longitudinally extending and horizontal bottom wall 170.

Parallel walls 169 and 170, which are vertically spaced, are provided with vertically aligned, pin receiving apertures 171 and 172 respectively. Each of these apertures 171 and 172 is designed to telescopingly receive a connecting pin 173.

With the connecting pin 173 inserted first through the aperture 172 and moved upwardly into the aperture 171, it may be secured in place by a supporting plate 174. Supporting plate 174 is, in turn, secured to wall 170 by a conventional snap ring 175.

The pin 173 may be removed downwardly through the aperture 172 without removing unit 1 from sill 10, merely by removing plate 22 and removing the snap ring 175 in a conventional manner so as to enable the supporting plate 174 to be removed.

With the FIG. 8 assembly, connection of the drawbar 15 to the mechanism 14 is effected by positioning the shank 168 within a recess portion 176 of the connecting means 14 so as to axially align the apertures 171 and 172 with the recess or passage 167. The connecting pin 173 may then be moved consecutively through the aperture 172, passage 167, and aperture 171. With the pin thus positioned, the plate 174 and 175 may be installed. Thereafter, sill plate 22 may be secured in place so as to overlap the plate 174.

The pin 173, of course, permits lateral pivotal movement of the drawbar 15.

Where the FIG. 8 connecting mechanism is employed, it will be appreciated that the sill plate 22, when secured to the sill, will provide a floor means operable to prevent downward movement of the pin 173 out of the slots 171 and 172, even if the plate 174 should inadvertently come free from the wall 170. By providing, in the sill floor 22, a longitudinally extending, open-ended slot 177, accommodation may be provided for the longitudinal movement of the tongue 17. The width of the slot 177 will be limited so as to provide sill floor portions underlying the lateral edges of the aperture 172 so as to affirmatively prevent inadvertent downward movement of the pin 173.

Where the sill floor 22 is thus employed, the buff movement of cylinder means 2 will be limited by engagement of side flanges 18*a* and 18*b* of connecting means 14 with vertically extending stops positioned within sill 10 and mounted on sill walls 72 and 73. With this arrangement, the sill mouth 19a will diverge laterally to accommodate pivoting movement of drawbar 15. This diverging mouth 19a will not be abuttingly engageable with flanges 18a and 18b so as to limit buff movement of the drawbar.

GENERAL MODE OF INSTALLATION OF CUSHIONING MECHANISM

By reference to FIG. 1, the mode of interconnection of the cushioning mechanism 1 with the drawbar 15 and the railway car sill 10 will be evident.

The housing 13 is welded in place within the sill 10, as previously described and as illustrated in FIG. 15.

Thereafter, the piston end of the cushioning mechanism 1 is inserted through the opening in the sill mouth 19a. The cushioning mechanism 1 is moved longitudinally through the sill so as to slide the bearing assembly 12 through the aperture 76 and into abutting engagement with the stop 74a. The securing plate 77 is then installed so as to effectively anchor the piston means 5 to the sill 10.

The coupler bar 15 is inserted into the recess in the connecting means 14 and secured in place in accordance with either the FIG. 6 or the FIG. 8 embodiment.

During the installation, the plate 22 is connected to the underside of the sill 10 so as to provide a floor operable to slidably support the cylinder means 2 of the cushioning mechanism 1.

Either before or after the installation of the drawbar 15, the restoring mechanism 16 is connected to the sill floor 22. The mechanism 16 is connected with the tongue portion 17 of the cylinder means 2 in the manner generally described in the U.S. Pat. No. 3,233,747 to Abbott.

SUMMARY OF ADVANTAGES AND SCOPE OF INVENTION

A principal advantage of the invention resides in the manner in which the valve mechanisms 96 serve to control "run-in" train action phenomena. The utilization of these mechanisms provides a system which is at all times operable to accommodate impact, i.e. coupling forces, and yet is also capable of providing an intensified impedance so as to control "run-in" train action events.

In the past, it has been suggested that excessive pressure responsive, relief valves may be provided in hydraulic cushioning devices so as to prevent the development of excessive pressures. However, the inertia of such relief valves, and the conventional biasing associated with them, inherently provides a relatively high impedance level for the dissipation of impact or coupler shocks, in direct contradistinction to the low impedance provided in the present invention for absorbing such impact or coupler shocks.

Further, the low impedance level of the present invention is immediately effective to absorb impact energy where relief valve systems inherently involve an operational delay, during which there is a danger of developing excessive hydraulic pressures.

Further, vent valve systems have an inherent propensity to provide undesirably high impedance in response to low-level, coupling action induced, impact forces. Thus, during such low-level coupling action, the vent valve systems tend to produce excessive impedance, so as to transmit excessively severe shock forces to the body of a railway car.

The unique utilization of "run-in" control valves in association with an exponential series of ports provides a mechanism operable to effect a generally linear dissipation of impact energy with no operational delay and yet be fully responsive to "run-in" train action events so as to control and limit the severity of this phenomena.

The systems for anchoring the piston rod and connecting the cylinder means of the cushioning device to a drawbar are uniquely simplified and virtually foolproof in installation.

The use of the "cantilever" supported piston, with the piston rod extending from one piston side only, substantially shortens the length of the cushioning mechanism, i.e. there is no need to accommodate for the reciprocating movement of a second piston rod. The complete elimination of an accumulator structure further contributes to the shortening of the cushioning device.

Even though a body of air is maintained within the cylinder means in direct intermixable contact with the hydraulic fluid, it is surprising to find that the mechanism is able to provide effective shock absorbing action.

A highly significant aspect of the invention involves the provision of a comprehensive system which enables a cushioning mechanism to effectively absorb coupler shocks, effect rapid restoration, and yet provide high impedance levels for controlling both "run-in" and "run-out" train action phenomena.

In describing the invention, reference has been made to preferred embodiment. However, those skilled in the railway cushioning art and familiar with the disclosure of this invention may envision additions, deletions, modifications and substitutions which fall within the purview of the art as defined in the appended claims.

We claim:

1. In a method of controlling train action phenomena, with apparatus including:
- impedance means provided between relatively movable cushioning members and operable to impede buff movement of train draft gear;
- said cushioning members including
  - at least one cushioning member connected with said draft gear, with said one cushioning member being movable generally longitudinally of a train vehicle, and
  - at least another cushioning member connected with said train vehicle; and
- said impedance means including
  - cavity means containing fluid interposed between said one and said other cushioning members,
  - passage means communicating with said fluid in said cavity means,
  - means operable to receive fluid displaced from at least a portion of said cavity means through said passage means in response to relative movement of said one and said other of said cushioning members, and
  - valve means operable to control fluid flow through at least a portion of said passage means;
- the steps of said method comprising:
  - providing, in response to buff forces acting on said draft gear and tending to produce run-in train action events, a first level of impedance in said impedance means;
  - providing, in response to buff coupling forces acting on said draft gear, a second level of impedance substantially less than said first level of impedance, in said impedance means;
  - maintaining said second, lesser level of impedance continuously operable in the absence of forces acting on said draft gear;
  - said run-in train action events generating generally lower level buff forces acting on said one of said cushioning members and said buff coupling forces generating generally higher level buff forces acting on said one of said cushioning members;
  - effecting said first level of impedance by disposing said valve means in an at least partially closed condition in response to said relatively lower level buff forces generated by run-in train action events and acting on said one cushioning member, with the attainment of said at least partially closed condition of said valve means being operable to increase an impedance to flow of fluid from said cavity means through said passage means;
  - continuously biasing said valve means toward an open condition, with said continuous biasing being operable

to effect said maintaining of said second, lesser level of impedance continuously operable in the absence of forces acting on said draft gear; and

effecting said second level of impedance by maintaining said valve means in said open condition in response to said relatively higher level, buff coupling forces acting on said one cushioning member.

2. In a method of controlling train action phenomena with apparatus including:

first hydraulic impedance means provided between relatively movable, cushioning members, with said first impedance means being operable to impede draft movement of railway car draft gear;

second hydraulic impedance means provided between said relatively movable cushioning members and operable to impede buff movement of said railway car draft gear;

said cushioning members including

at least one cushioning member connected with said draft gear, with said one cushioning member being movable generally longitudinally of a train vehicle, and at least another cushioning member connected with said train vehicle; and

said second impedance means including generally high pressure cavity means containing fluid interposed between said one and said other cushioning members,

passage means communicating with said fluid in said generally high pressure cavity means,

generally low pressure cavity means operable to receive fluid displaced from said generally high pressure cavity means through said passage means in response to relative movement of said one and said other of said cushioning members, and

valve means operable to control fluid flow through at least a portion of said passage means; and

wherein said method includes:

providing, in response to draft forces acting on said draft gear and tending to provide runout train action events, a relatively high hydraulic impedance level in said first impedance means; and

providing, in response to low level draft forces acting on said draft gear, a relatively low hydraulic impedance level in said first impedance means; and

maintaining said low hydraulic impedance level in said first impedance means continuously operable in the absence of forces acting on said draft gear;

the improvement comprising the steps of:

providing, in response to buff forces acting on said draft gear and tending to produce run-in train action events, a first level of hydraulic impedance in said second impedance means;

providing, in response to buff coupling forces acting on said draft gear, a second level of hydraulic impedance substantially less than said first level of hydraulic impedance in said second impedance means; and

maintaining said second, lesser level of hydraulic impedance in said second impedance means continuously operable in the absence of forces acting on said draft gear;

said run-in train action events generating generally lower level buff forces acting on said one of said cushioning members and said buff coupling forces generating generally higher level buff forces acting on said one of said cushioning members;

effecting said first level of impedance in said second impedance means by disposing said valve means in an at least partially closed condition in response to said relatively lower level buff forces generated by run-in train action events and acting on said one cushioning member, with the attainment of said at least partially closed condition of said valve means being operable to increase an impedance to flow of fluid from said generally high pressure cavity means through said passage means;

continuously biasing said valve means toward an open condition, with said continuous biasing being operable to effect said maintaining of said second, lesser level of impedance in said second impedance means continuously operable in the absence of forces acting on said draft gear; and

effecting said second level of impedance in said second impedance means by maintaining said valve means in said open condition in response to said relatively higher level, buff coupling forces acting on said one cushioning member.

3. Apparatus for controlling train action phenomena, said apparatus comprising:

relatively movable, cushioning members;

said cushioning members including

at least one cushioning member connected with draft gear, with said one cushioning member being movable generally longitudinally of a train vehicle, and

at least another cushioning member connected with said train vehicle;

impedance means disposed between said relatively movable cushioning members and operable to impede buff movement of said draft gear;

said impedance means including

cavity means containing fluid interposed between said one and said other cushioning members,

passage means communicating with said fluid in said cavity means,

means operable to receive fluid displaced from at least a portion of said cavity means through said passage means in response to relative movement of said one and said other of said cushioning members, and

valve means operable to control fluid flow through at least a portion of said passage means;

first means operable, in response to buff forces acting on said draft gear and tending to produce run-in train action events, to provide a first level of impedance in said impedance means;

second means operable, in response to buff coupling forces acting on said draft gear, to provide a second level of impedance substantially less than said first level of impedance in said impedance means;

third means operable to maintain said second, lesser level of impedance continuously operable in the absence of forces acting on said draft gear;

said run-in train action events being operable to generate generally lower level buff forces acting on said one of said cushioning members and said buff coupling forces being operable to generate generally higher level buff forces acting on said one of said cushioning members;

said first means being operable to effect said first level of impedance by disposing said valve means in an at least partially closed condition in response to said relatively lower level buff forces generated by run-in train action events and acting on said one cushioning member, with the attainment of said at least partially closed condition of said valve means being operable to increase an impedance to flow of fluid from at least a portion of said cavity means through said passage means;

said first means including valve closing means operable, in response to fluid flowing from at least said portion of said cavity means through said passage means as a result of said relatively lower level forces acting on said one of said cushioning members and generated by run-in train action events, to at least partially close said valve means and at least partially restrict fluid flow through at least a portion of said passage means;

said second means including disabling means operable, in response to fluid flowing from at least said portion of said cavity means through said passage means as a result of said relatively higher level forces acting on said one of said cushioning members and generated by buff coupling forces, to substantially prevent valve closing operation of said valve closing means;

said third means comprising resilient means continuously biasing said valve means toward a relatively open condition, with said continuous biasing being operable to effect said maintaining of said second, lesser level of impedance continuously operable in the absence of forces acting on said draft gear.

4. Apparatus for controlling train action phenomena, said apparatus comprising:

relatively movable cushioning members said cushioning members including

at least one cushioning member connected with draft gear, with said one cushioning member being movable generally longitudinally of a train vehicle,

at least another cushioning member connected with said train vehicle;

first impedance means acting between said relatively movable, cushioning members, with said first impedance means being operable to impede draft movement of said car draft gear;

second impedance means acting between said relatively movable cushioning members and operable to impede buff movement of said draft gear;

said second impedance means including

generally high pressure cavity means containing fluid interposed between said one and said other cushioning members,

passage means communicating with said fluid in said generally high pressure cavity means,

generally low pressure cavity means operable to receive fluid displaced from said generally high pressure cavity means through said passage means in response to relative movement of said one and said other of said cushioning members, and

valve means operable to control fluid flow through at least a portion of said passage means;

means operable, in response to draft forces acting on said draft gear and tending to provide runout train action events, to provide a relatively high impedance level in said first impedance means;

means operable, in response to low level draft forces acting on said draft gear, to provide a relatively low impedance level in said first impedance means;

first means operable, in response to buff forces acting on said draft gear and tending to produce run-in train action events, to provide a first level of impedance in said second impedance means;

second means operable, in response to buff coupling forces acting on said draft gear, to provide a second level of impedance in said second impedance means substantially less than said first level of impedance in said second impedance means; and

means operable to maintain said low level of impedance in said first impedance means continuously operable in the absence of forces acting on said draft gear;

third means operable to maintain said second, lesser level of impedance in said second impedance means continuously operable in the absence of forces acting on said draft gear;

said run-in train action events being operable to generate generally lower level buff forces acting on said one of said cushioning members and said buff coupling forces being operable to generate generally higher level buff forces acting on said one of said cushioning members;

said first means being operable to effect said first level of impedance in said second impedance means by disposing said valve means in an at least partially closed condition in response to said relatively lower level buff forces generated by run-in train action events and acting on said one cushioning member, with the attainment of said at least Partially closed condition of said valve means being operable to increase an impedance to flow of fluid from said generally high pressure cavity means through said passage means;

said first means including valve closing means operable, in response to fluid flowing from said generally high pressure cavity means through said passage means as a result of said relatively lower level forces acting on said one of said cushioning members and generated by run-in train action events, to at least partially close said valve means and at least partially restrict fluid flow through at least a portion of said passage means;

said second means including disabling means operable, in response to fluid flowing from said generally high pressure cavity means through said passage means as a result of said relatively higher level forces acting on said one of said cushioning members and generated by buff coupling forces, to disable said valve closing means, said disabling means including means operable to substantially isolate said valve closing means from fluid flowing from said generally high pressure cavity means through said passage means; and

said third means comprising resilient means continuously biasing said valve means toward a relatively open condition, with said continuous biasing being operable to effect said maintaining of said second, lesser level of impedance in said second impedance means continuously operable in the absence of forces acting on said draft gear.

5. Apparatus for controlling train action phenomena, said apparatus comprising:

relatively movable, cushioning members said cushioning members including

at least one cushioning member connected with draft gear, with said one cushioning member being movable generally longitudinally of a train vehicle,

at least another cushioning member connected with said train vehicle;

first hydraulic impedance means between said relatively movable, cushioning members, with said first impedance means being operable to impede draft movement of said draft gear;

second hydraulic impedance means acting between said relatively movable cushioning members and operable to impede buff movement of said draft gear;

said second impedance means including

generally high pressure cavity means containing fluid interposed between said one and said other cushioning members,

passage means communicating with said fluid in said generally high pressure cavity means,

generally low pressure cavity means operable to receive fluid displaced from said generally high pressure cavity means through said passage means in response to relative movement of said one and said other of said cushioning members, and

valve means operable to control fluid flow through at least a portion of said passage means;

means operable, in response to draft forces acting on said draft gear and tending to provide runout train action events, to provide a relatively high, hydraulic impedance level in said first impedance means;

means operable, in response to low level draft forces acting on said draft gear, to provide a relatively low, hydraulic impedance level in said first impedance means;

first means operable, in response to buff forces acting on said draft gear and tending to produce run-in train action events, to provide a first level of hydraulic impedance in said second impedance means;

second means operable, in response to buff coupling forces acting on said draft gear, to provide a second level of hydraulic impedance in said second impedance means substantially less than said first level of hydraulic impedance in said second impedance means;

means operable to maintain said low hydraulic impedance level in said first impedance means continuously operable in the absence of draft forces acting on said draft gear; and third means operable to maintain said second, lesser level of hydraulic impedance in said second impedance means continuously operable in the absence of buff forces acting on said draft gear;

said run-in train action events being operable to generate generally lower level buff forces acting on said one of said cushioning members and said buff coupling forces being operable to generate generally higher level buff forces acting on said one of said cushioning members;

said first means being operable to effect said first level of impedance in said second impedance means by disposing said valve means in an at least partially closed condition in response to said relatively lower level buff forces generated by run-in train action events and acting on said one cushioning member, with the attainment of said at least partially closed condition of said valve means being operable to increase an impedance to flow of fluid from said generally high pressure cavity means through said passage means;

said first means including valve closing means operable, in response to fluid flowing from said generally high pressure cavity means through said passage means as a result of said relatively lower level forces acting on said one of said cushioning members and generated by run-in train action events, to at least partially close said valve means and at least partially restrict fluid flow through at least a portion of said passage means;

said second means including disabling means operable, in response to fluid flowing from said generally high pressure cavity means through said passage means as a result of said relatively higher level forces acting on said one of said cushioning members and generated by buff coupling forces, to disable said valve closing means, said disabling means including means operable to substantially isolate said valve closing means from fluid flowing from said generally high pressure cavity means through said passage means; and

said third means comprising resilient means continuously biasing said valve means toward a relatively open condition, with said continuous biasing being operable to effect said maintaining of said second, lesser level of impedance in said second impedance means continuously operable in the absence of forces acting on said draft gear.

6. A railway cushioning device comprising:

cylinder means;

piston means disposed within said cylinder means;

one of said piston means and cylinder means being adapted to be connected with a railway car and the other of said piston and cylinder means being adapted to be connected with a coupling member;

port means carried by said cylinder means and operable to impede an outward flow of fluid from the interior of said cylinder means in response to relative movement between said cylinder means and piston means;

cavity means external of said cylinder means operable to receive a flow of fluid through said port means from the interior of said cylinder means;

a valve mechanism carried by said cylinder means and operable to impede a flow of fluid moving out of the interior of said cylinder means through said port means and into said cylinder means in response to buff force induced, relative movement between said piston means and cylinder means;

said valve mechanism including valve closing means operable in response to fluid flow through said port means caused by run in train action to at least restrict flow through at least a portion of said port means in response to run-in train action events;

said valve mechanism additionally including disabling means operable, in response to flow through said port means caused by buff coupling forces, to substantially isolate said valve closing means from fluid flow through said port means and maintain at least said portion of said port means substantially open;

yieldable biasing means operable to maintain at least said portion of said port means continuously open in the absence of forces acting on said coupling member and during operation of said disabling means in order to provide a relatively low impedance to flow through said port means.

7. A railway cushioning device comprising:

cylinder means;

piston means disposed within said cylinder means;

one of said piston means and cylinder means being adapted to be connected with a railway car and the other of said piston and cylinder means being adapted to be connected with a coupling member;

a plurality of port means intersecting a cylindrical wall of said cylinder means and operable to impede an outward flow of fluid from the interior of said cylinder means in response to relative movement between said cylinder means and piston means;

cavity means external of said cylinder means and operable to receive a flow of fluid through said plurality of port means from the interior of said cylinder means;

a valve mechanism carried by said cylindrical wall and operable to impede a flow of fluid moving out of the interior of said cylinder means through said port means and into said cavity means in response to buff force induced, relative movement between said piston means and cylinder means;

said valve mechanism including valve closing means operable in response to fluid flow through said port means caused by run-in train action to restrict flow through at least a portion of said port means in response to run-in train action events;

said valve mechanism additionally including disabling means operable, in response to flow through said port means caused by buff coupling forces, to substantially isolate said valve closing means from fluid flow through said port means and maintain at least said portion of said port means open; and

yieldable biasing means operable to maintain at least said portion of said port means continuously open in the absence of forces acting on said coupling member and during operation of said disabling means in order to provide a relatively low impedance to flow through said port means.

8. A railway cushioning device comprising:

cylinder means;

piston means disposed within said cylinder means;

one of said piston means and cylinder means being connected with a railway car and the other of said piston and cylinder means being connected with a coupling member;

a plurality of ports intersecting the wall of said cylinder means, spaced in an exponential pattern extending generally longitudinally of said cylinder means, and operable to impede an outward flow of fluid from the interior of said cylinder means in response to relative movement between said cylinder means and piston means;

a first plurality of said ports being continuously open;

a second plurality of said ports, with each port thereof being provided with a valve mechanism operable to control a flow of fluid moving out of said cylinder means in response to buff force induced, relative movement between said piston means and cylinder means;

each said valve mechanism including means operable to restrict flow through its associated port means in response to run-in train action events;

each said valve mechanism additionally including disabling means operable, in response to buff coupling forces, to maintain its associated port means fully open.

9. A railway cushioning device comprising:

housing means including

connecting means operable to connect said housing means with a coupling bar,

outer cylinder means,

inner cylinder means contained within said outer cylinder means, said inner cylinder means containing a high pressure cavity,

said inner and outer cylinder means being spaced to define a relatively low pressure cavity,

port means intersecting said inner cylinder means and providing restricted fluid communication between said low and high pressure cavities;

piston rod means passing axially through a first end of said outer cylinder means and an adjacent first end of said inner cylinder means;

piston means mounted within said inner cylinder means;

annular bearing means supporting said piston means for sliding movement relative to and within said inner cylinder means;

said piston rod means terminating in fixed connection with one side of said piston means;

said inner cylinder means including first cylinder head means at said one end of said inner cylinder means;

said inner cylinder means including a second, aperture free, closed cylinder head disposed at a second end of said inner cylinder means and facing another side of said piston means opposite to said one side;

generally annular check valve means carried by said first cylinder head means, and operable to open by moving generally away from said first cylinder head means and toward said one side of said piston means;

passage means providing fluid communication between said low pressure cavity and said check valve means;

third cylinder head means, spaced from said first cylinder head means, and operable to close said first end of said outer cylinder means

web means supporting said first cylinder head means in axially aligned and axially spaced relation relative to said third cylinder head means;

resilient restoring means tending to resiliently position said piston means at one extremity of said inner cylinder means,

first port means disposed at said second end of said inner cylinder means generally adjacent said second cylinder head means;

first check valve means operable to permit fluid flow through said first port means from said low pressure cavity to said high pressure cavity;

a plurality of second port means formed in said inner cylinder means, spaced generally exponentially of the longitudinal axis of said inner cylinder means, and disposed between said first port means and said first cylinder head means;

second control valve means controlling fluid flow through each of said second port means and operable to permit fluid flow from said high pressure cavity to said low pressure cavity;

each said second control valve means being operable to substantially restrict fluid flow through its associated second port means in response to run-in train action event forces acting on said coupling bar, and operable to maintain its associated second port means substantially unobstructed in response to buff coupling forces acting on said coupling bar;

third port means formed in said inner cylinder means and disposed between said second port means and said first cylinder head means;

third control valve means operable to control flow through said third port means; and

said third control valve means being operable, in response to runout train action event forces acting on said coupling bar to substantially restrict fluid flow through said third port means, said third control valve means being operable to maintain said third port means substantially open in response to force imposed on said coupling means by said restoring mechanism.

10. A cushioning device as described in claim 9:

wherein said device further includes anchoring means for fixedly securing one end of said piston rod means within a railway car sill, said anchoring means comprising

generally rectangular housing means adapted to be fixedly secured to said sill means,

said housing means having an apertured wall portion through which one end of said piston rod means passes,

spherical bearing means carried at one end of said piston rod means within said housing,

fixed abutment means engaging one end of said spherical bearing means, and

U-shaped retaining means straddling said one end of said piston rod means and engaging another end of said spherical bearing means,

said U-shaped retaining means and said fixed abutment means cooperating to fixedly position said spherical bearing means within said housing means; and

said connecting means comprising

a first, generally vertically extending, sidewall and a second, generally vertically extending, sidewall horizontally spaced from said first sidewall,

a recess formed on the interior of said first sidewall generally facing said second sidewall, said recess being operable to abuttingly receive one end of a coupling bar retaining key,

aperture means intersecting said second sidewall and operable to permit said key to pass telescopingly therethrough and abuttingly engage said recess means, said key means, when engaged with said recess means being restrained against longitudinal movement by said first and second sidewalls, and

pivoted latch means carried on the interior of said second sidewall and operable to pivot downwardly to latchingly engage said key.

11. A cushioning device as described in claim 9:

wherein said device further includes anchoring means for fixedly securing one end of said piston rod means within a railway car sill, said anchoring means comprising

generally rectangular housing means adapted to be fixedly secured to said sill means,

said housing means having an apertured wall portion through which one end of said piston rod means passes,

spherical bearing means carried at one end of said piston rod means within said housing,

fixed abutment means engaging one end of said spherical bearing means, and

U-shaped retaining means straddling said one end of said piston rod means and engaging another end of said spherical bearing means,

said U-shaped retaining means and said fixed abutment means cooperating to fixedly position said spherical bearing means within said housing means;

said connecting means comprising

upper wall means, and

lower wall means spaced beneath said upper wall means,

first, draft bar coupling, pin-receiving aperture means formed in said upper wall means,

second pin-receiving aperture means formed in said lower wall means immediately beneath said upper wall means,

plate means operable to prevent movement of said pin means downwardly out of said second pin-receiving means, and

floor means disposed beneath said plate means and operable to prevent said plate means from moving downwardly away from said second recess means so as to allow a draft bar coupling pin received in said first and second pin-receiving means to move downwardly out of said first and second pin-receiving means.

12. A railway cushioning device comprising:

housing means including

connecting means operable to connect said housing means with a coupling bar,

outer cylinder means,

inner cylinder means contained within said outer cylinder means,

said inner cylinder means containing a high pressure cavity, said inner and outer cylinder means being spaced to define a relatively low pressure cavity,

port means intersecting said inner cylinder means and providing restricted fluid communication between said low and high pressure cavities;

piston rod means passing axially through a first end of said outer cylinder means and an adjacent first end of said inner cylinder means;

piston means mounted within said inner cylinder means;

annular bearing means supporting said piston means for sliding movement relative to and within said inner cylinder means;

said piston rod means terminating in fixed connection with one side of said piston rod means;

said inner cylinder means further including first cylinder head means at said one end of said inner cylinder means;

said inner cylinder means including a second, aperture free, closed cylinder head disposed at a second end of said inner cylinder means and facing another side of said piston means opposite to said one side;

generally annular check valve means carried by said first cylinder head means, and operable to open to permit fluid flow into the interior of said inner cylinder means;

passage means providing fluid communication between said low pressure cavity and said check valve means;

third cylinder head means spaced from said first cylinder head means, and operable to close said first end of said outer cylinder means;

web means supporting said first cylinder head means in axially aligned and axially spaced relation relative to said third cylinder head means;

resilient restoring means tending to resiliently position said piston means at a defined position within said inner cylinder means;

first port means in said inner cylinder means disposed generally adjacent said second cylinder head means;

first check valve means operable to permit fluid flow through said first port means from said low pressure cavity to said high pressure cavity;

a plurality of second port means formed in said inner cylinder means, spaced generally exponentially of the longitudinal axis of said inner cylinder means, and disposed between said first port means and said first cylinder head means;

second control valve means controlling fluid flow through each of said second port means and operable to permit fluid flowing from said high pressure cavity to said low pressure cavity

each said second control valve means being operable to substantially restrict fluid flow through its associated second port means in response to run-in train action event forces acting on said coupling bar, and operable to maintain its associated second port means substantially unobstructed in response to buff coupling forces acting on said coupling bar;

third port means formed in said inner cylinder means and disposed between said second port means and said first cylinder head means;

third valve means operable to control flow through said third port means;

said third control valve means being operable, in response to runout train action event forces acting on said coupling bar to substantially restrict fluid flow through said third port means, said third control valve means being operable to maintain said third port means substantially open in response to force imposed on said coupling means by said restoring mechanism; and

anchoring means for fixedly securing one end of said piston rod means within a railway car sill, said anchoring means comprising

generally rectangular housing means fixedly secured to said sill means,

said housing means having an apertured wall portion through which one end of said piston rod means passes,

spherical bearing means carried at one end of said piston rod means within said housing,

fixed abutment means engaging one end of said spherical bearing means, and

U-shaped retaining means straddling said one end of said piston rod means and engaging another end of said spherical bearing means,

said U-shaped retaining means and said fixed abutment means cooperating to fixedly position said spherical bearing means cooperating to fixedly position said spherical bearing means within said housing means;

a body of piston means movement impeding fluid fully occupying said high pressure cavity of said inner cylinder means; and

a body of air contained within said low pressure cavity, said body of air being in direct communication with said piston means movement impeding fluid and operable to intermix therewith.